
WATERLINES

News affecting the management and use of Indiana's water resources

DIVISION OF WATER
INDIANA DEPARTMENT OF NATURAL RESOURCES
FALL-WINTER 2000

DAM SAFETY – VITALLY IMPORTANT

Dams bring water, power, flood control, recreation, economic possibilities, and many other advantages to people. However, people must keep in mind that safe operation and maintenance is key to sustaining these advantages and avoiding potential disaster from failure.

Water is one of our most precious resources. Nothing can live without it. But there has to be the right amount of water in the right place at the right time. Throughout the history of humankind, people have built dams to maximize their use of this vital resource.

Today, dams provide communities and individuals with great benefits because of their multipurpose uses. Dams provide flood control; increases in water supply for drinking; irrigation for farming; recreational areas; and clean, renewable energy through hydropower. As populations have grown and moved to arid or flood-prone locations, the need for dams has increased. Millions of people in every state in the United States depend on dams to bring them the benefits mentioned above.

The purpose of a dam is to impound (store) water, wastewater, or liquid borne materials. Man-made dams may be classified according to the type of construction material used, the methods used on

construction, the slope or cross-section of the dam, the way the dam resists the forces of the water pressure behind it, the means for controlling seepage and, occasionally according to the purpose of the dam.

Construction

The materials used for construction of dams include earth, rock, concrete, masonry, steel, timber, miscellaneous materials (such as plastic or rubber) and any combination of these materials.

Embankment dams are the most common type of dam in use today. Typical materials used for embankment dams include natural soil and rock. Concrete dams are another type of dam. Concrete dams may be categorized into gravity and arch dams according to the designs used to resist the stress due to reservoir water pressure.

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Because the purpose of a dam is to safely retain water, the water retention ability of a dam and the ability of the spillway system to safely pass flood water is of prime importance.

Overtopping of an embankment dam is very undesirable because the embankment materials

some dams are equipped with auxiliary spillways to manage extreme floods.

Ownership

Dam owners are solely responsible for the safety and the liability of the dam and for financing its upkeep, upgrade and repair. While most infrastructure facilities are owned by public entities (roads, bridges, sewer systems, etc.) the majority of dams in this country are privately owned.

Safety

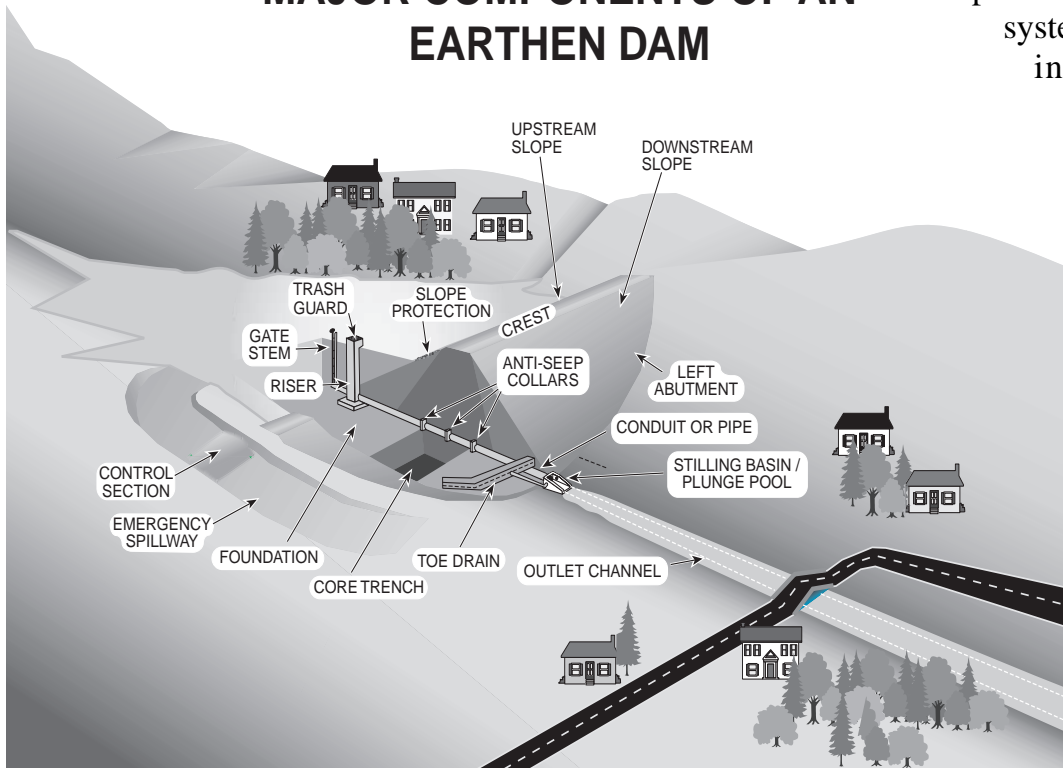
Safety is key to the effectiveness of a dam. A top issue facing the dam safety community is the risk of dam failure. Dam failures can be devastating for the dam owners, to the dam's intended purpose and, especially for downstream populations and property. Property damage can range from the thousands to the billions of dollars. No price can be

put on the lives that have been lost and could be lost in the future due to dam failure. Dam failures are most likely to happen for one of five reasons:

- Overtopping, caused by water spilling over the top of a dam
- Structural failure of materials used in dam construction
- Stability failure of the foundation or other features that hold the dam in place
- Cracking caused by movements like the natural settling of a dam
- Inadequate maintenance and upkeep
- Piping – when seepage through a dam is not properly filtered and soil particles continue to progress and form sink holes in the dam

There is also an aging issue. Dams age like any

MAJOR COMPONENTS OF AN EARTHEN DAM



may be eroded away. Additionally, only a small number of concrete dams have been designed to be overtopped. Water normally passes through the main spillway or outlet works; it should pass over an auxiliary spillway only during periods of high reservoir levels and high water inflow.

All embankment and most concrete dams have some seepage. However, it is important to control the seepage to prevent internal erosion and instability. Proper dam construction and maintenance and monitoring of seepage provide this control.

Intentional release of water is confined to water releases through outlet works and spillways. A dam typically has a principal or mechanical spillway and a drawdown facility. Additionally,

man-made structure. With age comes potential deterioration. Additionally, over time, technical standards are improved and downstream areas become more heavily populated. All these items affect the need to upgrade the dam. Many dams have been designed for an effective life of 50 years (although a properly designed dam can last much longer if it is maintained). The majority of dams in this country are quickly approaching this age and rehabilitation of these structures is a major concern. In fact, it has been estimated, based on dam inventory data, that, in the year 2000, 30 percent of dams were 50 years old. In the year 2020, 80 percent of the dams will reach the half-century mark.

Regulation

Early in this century, as many dams failed due to lack of proper engineering and maintenance, it was recognized that some form of regulation was needed. One of the earliest state programs was enacted in California in the 1920s. Federal agencies, such as the Corps of Engineers and the Department of the Interior, Bureau of Reclamation built many dams during the early part of the twentieth century and established safety standards during this time. Slowly, other states began regulatory programs. But it was not until the string of significant dam failures of the 1970s that the level of awareness was raised among the states and the federal government.

Today, every state but Alabama and Delaware have dam safety regulatory programs. In Indiana, the Department of Natural Resources, Division of Water, Dam Safety Section, administers the dam safety regulatory program.

See the related Waterlines article regarding general guidelines for new and improvements to existing Indiana dams on page 6.

*modified from an article by the Association of State Dam Safety Officials, Dam Safety 101, October 2000 ☞

ON-LINE TRAINING FOR INSURANCE AGENTS THE NEW ELEVATION CERTIFICATE



The National Flood Insurance Program (NFIP) introduced the first in a series of on-line training for insurance agents – the New Elevation Certificate. This training module would also be very helpful for local floodplain administrators.

This training on the new Elevation Certificate is a self-paced training program. It will allow agents to skip over material that they already know and concentrate on the material they don't know. The training contains frequent practical learning exercises to reinforce learning. There are also links to other resources such as the Flood Insurance Manual.

This simple but practical approach to learning will enhance the insurance agents' knowledge to provide complete service to their clients, as well as help to eliminate costly errors and omissions claims.

Currently the "Gold Level" is available on-line. A "Green Level" (easier) and the "Platinum Level" (more challenging) are now in production.

To access this excellent "free" on-line training, go to the FEMA web site at <http://www.fema.gov/nfip/faatc.htm>. It is very worthwhile. ☞

FLOOD-RESISTANT MATERIALS REQUIREMENT

The requirement to use construction and finishing materials that are resistant to flood damage in all new and substantially improved buildings in identified Special Flood Hazard Areas (SFHAs) is an important part of the National Flood Insurance Program's (NFIP's) flood-damage-resistant design and construction standards. A residential building's lowest floor is required to be elevated to or above the Flood Protection Grade (FPG) in Indiana. (FPG is the Base Flood Elevation plus two feet.) All construction below the lowest floor is susceptible to flooding and must consist of flood-resistant materials. Uses of enclosed areas below the lowest floor in a residential building are limited to parking, building access, and limited storage—areas that can withstand inundation by floodwater without sustaining significant structural damage.

“Flood-resistant material” is defined as any building material capable of withstanding direct and prolonged contact with floodwaters without sustaining significant damage. The term “prolonged contact” means at least 72 hours, and the term “significant damage” means any damage requiring more than low-cost repair (such as painting).

As stated above, all structural and non-structural building materials at or below the FPG must be flood resistant. This requirement applies regardless of the expected or historic flood duration.

An NFIP flood insurance requirement regarding the use of materials in areas below the FPG must also be considered. Flood insurance will not pay a claim for finishing materials (such as clay floor tiles) located in basements or enclosed areas below the lowest floor of an elevated building, even if such materials are considered to be flood-resistant. The NFIP defines finishing materials as anything beyond basic wall construction.

The table below classifies building materials according to their ability to resist flood damage.

Flood-Resistant Classification of Materials		
NFIP	Class	Class Description
ACCEPTABLE	5	Highly resistant to floodwater damage. Materials within this class are permitted for partially enclosed or outside uses with essentially unmitigated flood exposure.
	4	Resistant to floodwater damage. Materials within this class may be exposed to and/or submerged in floodwaters in interior spaces and do not require special waterproofing protection.
UNACCEPTABLE	3	Resistant to clean water damage. Materials within this class may be submerged in clean water during periods of intentional flooding.
	2	Not resistant to water damage. Materials within this class require essentially dry spaces that may be subject to water vapor and slight seepage.
	1	Not resistant to water damage. Materials within this class require conditions of dryness.

Source: COE 1992 “Floodproofing Regulations”

For further information regarding flood-resistant materials requirements for buildings located in SFHAs and the classification of specific types of flooring materials, wall materials, and ceiling materials, you may obtain a copy of FEMA Technical Bulletin 2-93. Technical Bulletins can be ordered from the FEMA Publication Center at 1-800-480-2510 or the DNR Division of Water at 1-877-928-3755.

*excerpted from FEMA Technical Bulletin 2-93



CONFERENCE CORNER

ASFPM CONFERENCE

On June 3-8, 2001, the Association of State Floodplain Managers (ASFPM) will hold its 25th Annual Conference at the Adams Mark Hotel in Charlotte, North Carolina. As the major floodplain management conference in the country, this annual event attracts a broad audience including local, state and federal government officials, engineers, consultants, planners, related non-profit organizations, researchers, educators, and involved citizens.

This year's conference will look at New Trends in Floodplain Management – Plan, Prepare, Protect. The technical program runs Tuesday through Thursday, with additional training workshops on Monday and Friday. Through technical field tours and breakout sessions, attendees will have ample opportunities to see how Charlotte has dealt with the challenge of being one of the five fastest growing metro areas in the US. For those who seek Certified Floodplain Manager status, the conference will also offer the national exam.

Greg Main of the Indiana Department of Natural Resources, Division of Water, is the Program Chair for the upcoming conference. For further information regarding this conference, go to the ASFPM web site at asfpm@floods.org.

MIDWEST REGIONAL TECHNICAL DAM SAFETY SEMINAR

In November, the Indiana DNR, Division of Water hosted a regional dam safety seminar in cooperation with the Association of State Dam Safety Officials, a national professional organization. Midwest Seminars are held annually; however, this was the first event of its type hosted by Indiana. Over sixty people attended the seminar - twice the attendance of any previous Midwest seminar. State, local, federal and university representation came from Ohio, Illinois,

Indiana, Michigan, Kentucky, Wisconsin, Minnesota, Missouri, Tennessee, and Arkansas. Approximately one-third of the attendants came from consulting firms located throughout the Midwest. Federal agencies present included the Tennessee Valley Authority, the Natural Resources Conservation Service, the US Forest Service, and the Federal Energy Regulatory Commission.

The seminar covered the topics of hydrologic analysis methods and parameters, spillway design floods, and dam failure analysis required to evaluate downstream flooding conditions resulting from a dam failure. Ms. Ellen Faulkner, P.E., was the primary speaker. Ms. Faulkner works for the consulting firm of Mead & Hunt, in Eau Claire, Wisconsin. Ms. Faulkner has also been a contributing editor to Hydro Review magazine since 1995, working mainly with technical articles related to all aspects of hydropower.

Additional speakers included Kevin Griebenow and Steve Spicer, Federal Energy Regulatory Commission, George Crosby and Dave Knipe, Indiana DNR, Jim Alexander, Missouri DNR, Terry Cummings, Wisconsin DNR, Paul Mauer, Illinois DNR, Paul Wessel, Michigan DNR, and John Ludwig, Minnesota DNR. ~~~

INAFSM 4th ANNUAL CONFERENCE

The Indiana Association for Floodplain and Stormwater Management (INAFSM) held the organization's 4th annual meeting and conference on September 13-15, 2000 at the Fourwinds Resort in Bloomington, Indiana. Mayor John Fernandez, City of Bloomington, welcomed conference participants. Guest speaker at the conference banquet was Morton Marcus of the Indiana University Kelley School of Business. The conference featured several informative sessions regarding floodplain and stormwater management.

During the conference, the following awards were presented to outstanding programs and individuals for 2000: Award for Excellent Strides in Floodplain Management – City of Indianapolis; Excellence in Floodplain Management Award – Scott Zeigler, Noble County Surveyor; Excellence in Stormwater

Management Award – George Van Til, Lake County Surveyor: Chairman’s Award for Outstanding Service in Support of INAFSM– Sean Gorman of the Department of Natural Resources, Division of Water. Congratulations!

The Certified Floodplain Managers Exam was offered on the last day of the INAFSM conference. Steve Banagh of Christopher B. Burke Engineering, William Trakimas of ISO, Rodney Renkenberger of the Maumee River Basin Commission, and Anita Nance of the Department of Natural Resources, Division of Water completed the exam and all four passed. Congratulations to the new Certified Floodplain Managers! There are now seven individuals who are registered as Certified Floodplain Managers (CFMs) in the State of Indiana.

The election of new officers for 2001 was also conducted at the conference. The new INAFSM Chair will be Rodney Renkenberger. Vice Chair will be Michael DeBoy, Debbie Smith will serve as Secretary, Treasurer will be Jeff Healy, and Donna Price will be the Past Chair. The **5th Annual INAFSM Conference** will be September 12-14, 2001 at the Holiday Inn at South Bend, Indiana. For further information contact Mike DeBoy at (317) 634-6434. ~

GENERAL GUIDELINES FOR NEW DAMS AND IMPROVEMENTS TO EXISTING DAMS IN INDIANA

Impounding water with a dam is a hazardous activity. In the event of a dam failure, issues of primary concern include loss of human life, economic loss associated with property damage, lifeline disruption, cultural resource damage, and environmental damage. Adding to the concern is the fact that dams age, like any man-made infrastructure item. With age comes potential deterioration and the fact that downstream areas frequently become more heavily populated. Construction methods, construction materials, and

maintenance determine how susceptible, or resistant, a dam may be to failure.

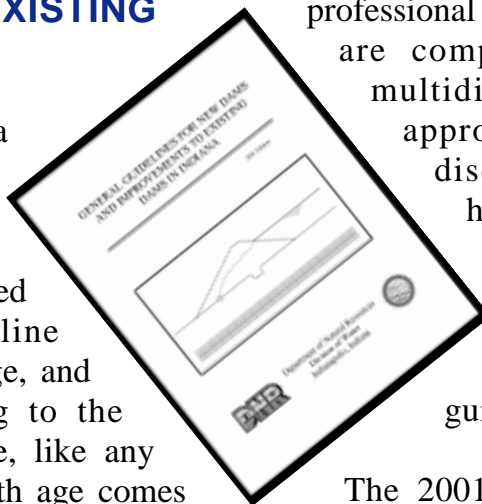
The production of technical plans for the repair, modification, construction and operation of a safe dam is a complex and expensive activity. Dam owners should obtain the services of a professional engineer experienced in dam design, construction and operation to develop plans and obtain approval from the Department of Natural Resources, Division of Water, before work begins on a dam that meets any of the following:

1. The height of the dam is equal or greater than 20 feet from the crest of the embankment to the original streambed.
2. The volume impounded by the dam to the spillway is 100-acre feet or more.
3. The drainage area upstream of the dam is 1 square mile or greater.

To help clarify appropriate design, analysis, and documentation that should be developed for repair, modification, construction and operation of a safe dam, the Division of Water assembled a committee of 17 governmental, private consultant, and academic professionals. This group developed guidelines for new dams and improvements to existing dams.

These guidelines provide direction to experienced dam design professionals so that the final product, the dam, is safe and the owner’s investment in professional engineering is maximized. Dams are complex structures that require a multidisciplinary analysis and design approach. The guidelines cover disciplines such as surveying, hydrology, hydraulics, geology, and geotechnical, as well as plan and specification development. An outline of an emergency action plan is also included in the guidelines.

The 2001 guidelines have been mailed to engineering firms practicing in the area of dam design throughout Indiana. ~



PRECIPITATION REPORT FOR JULY THROUGH DECEMBER 2000

July went into the climatological records as one of the coolest of record. For much of July, weather conditions were very pleasant. For portions of Indiana, this was the fourth consecutive month of above normal precipitation, while many areas of northern, central and southeast Indiana had below normal rainfall during July.



For a large part of Indiana, August was one of the wetter Augusts. Monthly rainfall ranged from less than 2 inches to over 12 inches. The wettest area was the southwestern part of the state. A few locations in Knox and Daviess counties received more than 12 inches of rain during August. This would be more than 300% of normal. The driest areas were in northern Indiana where rainfall was less than 2 inches. This would be less than 50% of normal. Rainfall from a storm system early in the month caused the White River at Petersburg to rise more than 12½ feet in 36 hours. September also proved to be a wet month with above normal precipitation reported in most areas.

The greatest October flood to strike portions of the White River in southwest Indiana since 1926

occurred during the first half of October. This was the greatest September or October flood at Petersburg since 1926. The Petersburg site drains about 31% of the State of Indiana. For central portions of the state, this was the seventh consecutive month of above normal precipitation. In contrast, northern Indiana was drier than normal in October.

Generally, November's precipitation was below normal. An arctic blast on the 21st of November gave central Indiana its first measurable snow of the season. Although less than an inch, this was the first measurable snow to occur in central Indiana during November since 1997.

The year 2000 ended on a chilly note being the second coldest December of record in Indiana. Near record snowfalls occurred in many areas. Indianapolis recorded the fourth snowiest December on record while South Bend had the snowiest December in recorded history with 44.6 inches of snowfall. Monthly liquid precipitation ranged from 2 to 4 inches, which is 75% to 125% of normal. It is unusual that such a cold month would have near normal liquid precipitation. Nearly all this precipitation fell as snow in northern Indiana, while in central and southern Indiana more fell as rain. ❄️

<div>  <div>KEY:</div> <div> <div>ACTUAL (INCHES)</div> <div>NORMAL (INCHES)</div> </div>  </div>							
Airport	July	August	September	October	November	December	Totals
Locations	2000	2000	2000	2000	2000	2000	2000
CHICAGO	3.58	2.26	3.59	1.12	2.71	2.11	31.62
IL	3.66	4.22	3.82	2.41	2.92	2.47	35.84
SOUTH BEND	2.88	1.49	3.22	2.28	3.07	2.29	33.44
IN	3.82	3.67	3.62	3.08	3.27	3.30	39.14
FORT WAYNE	2.18	3.68	4.61	1.78	2.12	2.54	33.82
IN	3.45	3.37	2.67	2.49	2.79	2.89	34.75
INDIANAPOLIS	2.95	4.26	4.82	3.08	2.67	2.76	37.76
IN	4.47	3.64	2.87	2.63	3.23	3.34	40.05
EVANSVILLE	4.14	5.60	5.03	0.60	3.43	4.11	48.18
IN	4.04	3.11	2.97	2.87	3.73	3.67	43.14
LOUISVILLE	3.51	2.87	5.36	0.89	2.97	3.72	44.29
KY	4.51	3.54	3.16	2.71	3.70	3.64	44.39
CINCINNATI	3.53	2.90	4.78	1.37	2.33	3.18	42.39
OH	4.24	3.35	2.88	2.86	3.46	3.15	41.33

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The work that provides the basis for this publication was supported by funding under a cooperative agreement with the Federal Emergency Management Agency. The author and publisher are solely responsible for the accuracy of the statements, and interpretations contained in the publication. Such interpretations do not necessarily reflect the views of the Federal Government.

THANK YOU

Thank you to those contributing to this issue of *Waterlines*: Dave Barnhill, Dave Knipe, George Crosby, Ed Reynolds, Debbie Smith, and Greg Main.

Editor - Anita Nance

Waterlines is published biannually as a public service by the Division of Water, Indiana Department of Natural Resources. The cooperation and assistance of the National Weather Service is gratefully acknowledged.

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